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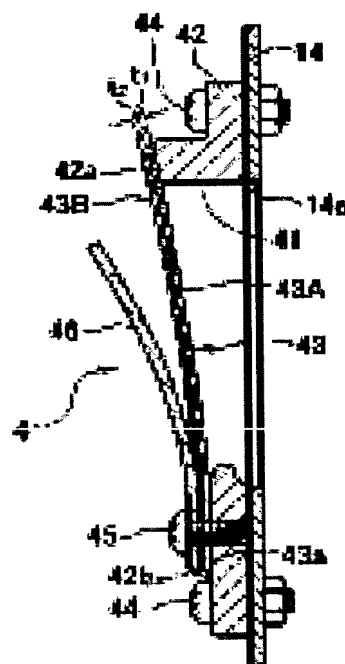
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## (54) VALVE DEVICE FOR SILENCER

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To suppress resonance, caused by fluctuation of exhaust pressure, of an elastically flexible plate-type valve whose one end is fixed to a valve fixing portion of a housing.

**SOLUTION:** In this valve device, a plate-type valve 43 consists of two layers of a first sheet member 43A located upstream of exhaust gas flow and a second sheet member 43B located downstream thereof. Flexing of the plate-type valve 43 causes friction between the first and second sheet members 43A and 43B. Also, the first sheet member 43A is made thicker than the second sheet member 43B to make difference between natural frequencies of the two sheet members 43A and 43B.



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**CLAIMS**

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[Claim(s)]

[Claim 1] the laminated structure according [ on what is constituted from a tabular valve which was equipped with the following, could bend elastically, could deform the bulb, and fixed the end section to housing, and ] this tabular valve to two or more sheet metal members -- carrying out -- bending deformation of a tabular valve -- these sheet metal -- the bulb equipment for silencers characterized by making it friction between members arise Housing which is bulb equipment which opens the bypass path of the exhaust gas in a silencer when an exhaust pressure rises to place constant pressure, and has the valve port to which exhaust gas circulates. The bulb which opens and closes a valve port.

[Claim 2] two or more aforementioned sheet metal -- the sheet metal located in the upstream of an exhaust air gas stream in a member -- the sheet metal located in a downstream in the board thickness of a member -- the bulb equipment for silencers according to claim 1 characterized by thickening as compared with the board thickness of a member

[Claim 3] two or more aforementioned sheet metal -- the sheet metal located in the upstream of an exhaust air gas stream in a member -- the sheet metal located in a downstream in the area of a member -- the claim 1 which enlarges as compared with the area of a member and is characterized by forming a level difference in the peripheral face of a tabular valve, and the bulb equipment for silencers given in two

[Claim 4] two or more aforementioned sheet metal -- the claim 1 characterized by distinguishing between the length from the end section of a member to the other end, and the bulb equipment for silencers given in two

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**DETAILED DESCRIPTION**

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[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the bulb equipment which opens the bypass path of the exhaust gas in a silencer still in detail when an exhaust pressure rises to place constant pressure about the bulb equipment for silencers mainly interposed in the exhaust air system of the engine for vehicles.

[0002]

[Description of the Prior Art] An applicant for this patent as this kind of bulb equipment previously by Japanese Patent Application No. No. 110580 [ ten to ] It has housing which has the valve port to which exhaust gas circulates, and the bulb which open and close a valve port. Can bend elastically, can deform a bulb and the end section is constituted from a tabular valve fixed to housing. It is sat after the tabular valve has been energized by the elastic stability by bending deformation of self by the valve seat section prepared in the periphery of the valve port of the housing side which fixed the tabular valve at the closing side. By that by which a tabular valve bends in an aperture side and the valve port was opened when the exhaust pressure exceeding this elastic stability acted on a tabular valve, and Japanese Patent Application No. No. 177414 [ ten to ] While a square pipe steel is cut into round slices, and forming housing, raising the one-side portion of one opening edge of this housing made from a square pipe steel and forming a bulb fixed part The tabular valve was \*\*\*\*ed, stopped and made this, the enclosure wall which encloses a tabular valve with pipe walls other than the bulb fixed part of housing was constituted, and what omitted the valve seat to which a tabular valve sits down is proposed.

[0003]

[Problem(s) to be Solved by the Invention] Although opening-and-closing vibration arises in the thing of the above-mentioned conventional example in the tabular valve which you are made to open and close by the exhaust air gas stream, when in agreement with the resonant frequency of the tabular valve with which this opening-and-closing vibration frequency is formed by the single member, a tabular valve will resonate. Resonance of this tabular valve will become strong if bending deformation of a tabular valve, i.e., the opening of a bulb, becomes large. In order to plan the soup of an engine, even if he wants to enlarge the maximum opening of a bulb, it becomes impossible therefore, to set up opening as a demand.

[0004] this invention makes it the technical problem to offer the bulb equipment for silencers which enabled it to suppress resonance of a tabular valve in view of the

above point.

[0005]

[Means for Solving the Problem] Housing which has the valve port to which it is bulb equipment which opens the bypass path of the exhaust gas in a silencer by this invention that the above-mentioned technical problem should be solved when an exhaust pressure rises to place constant pressure, and exhaust gas circulates, the laminated structure according [ on what is constituted from a tabular valve which was equipped with the bulb which opens and closes a valve port, could bend elastically, could deform the bulb, and fixed the end section to housing, and ] this tabular valve to two or more sheet metal members -- carrying out -- bending deformation of a tabular valve -- these sheet metal -- it is made for friction between members to arise

[0006] according to this -- opening-and-closing vibration of a tabular valve -- composition -- the sheet metal which counters in this case although two or more sheet metal members of each which are members also repeat the same opening-and-closing vibration -- a member -- since the frictional heat by friction arises and the energy of opening-and-closing vibration is diffused as heat energy in between, oscillating amplification of a tabular valve can be prevented

[0007] moreover -- for suppressing resonance of a tabular valve more effectively -- each sheet metal -- making the resonant frequency of a member different from \*\* wishes -- having -- it -- each sheet metal -- what is necessary is just to make the board thickness, area, and length of a member different from \*\* the sheet metal located in a valve seat side, i.e., the upstream of an exhaust air gas stream, here with the bulb equipment of the type with which a tabular valve sits down to a valve seat when securing the endurance of a tabular valve, in order that a tabular valve may strike a valve seat -- the sheet metal located in a downstream in the board thickness of a member -- it is desirable to thicken as compared with the board thickness of a member moreover, the sheet metal located in the upstream of an exhaust air gas stream -- the sheet metal located in a downstream in the area of a member -- the force which will force the sheet metal member of an upstream on the sheet metal member of a downstream by the contamination of the exhaust air gas stream to the aforementioned level difference at the time of valve opening of a tabular valve if it enlarges as compared with the area of a member and a level difference is formed in the peripheral face of a tabular valve -- generating -- sheet metal -- a member -- the frictional force of a between increases and a periodic-damping

[0008]

[Embodiments of the Invention] It is the silencer with which 1 is interposed in the

middle of the exhaust air system of an internal combustion engine with reference to drawing 1 . The tubed shell 11, One pair of the 1st and 2nd separator 14 and 15 is formed in the main part of a silencer which consists of end walls 12 and 13 which blockade the end and the other end of shell 11. the space in a main part The 1st silence room 31 between the end wall 12 and the 1st separator 14, It has divided in the 2nd silence room 32 between the 1st separator 14 and the 2nd separator 15, and the 3rd silence room 33 between the 2nd separator 15 and the other end wall 13. Furthermore, the exhaust air inhalant canal 21 which penetrates the end wall 12, the 1st separator 14, and the 2nd separator 15 to a silencer 1, respectively, and is open for free passage with the 3rd silence room 33 to it, The inner pipe 22 which penetrates the 2nd separator 15 and the 1st separator 14, respectively, and opens the 3rd silence room 33 and the 1st silence room 31 for free passage, The exhaust air excurrent canal 23 which the 1st separator 14, the 2nd separator 15, and the other end wall 13 are penetrated [ excurrent canal ], respectively, and makes the atmosphere open the 1st silence room 31 for free passage is formed.

[0009] And while drilling much bore 21a in the tube wall of 2nd silence room 32 portions of the exhaust air inhalant canal 21, much bore 22a is drilled also in the tube wall of 2nd silence room 32 portions of the inner pipe 22, and the exhaust air inhalant canal 21 and the inner pipe 22 are made into the structure which can be open for free passage through the 2nd silence room 32.

[0010] According to this, the distribution channel of the exhaust gas which flowed into the exhaust air inhalant canal 21 becomes two lines with the path which results in the exhaust air excurrent canal 23 through the path which results in the exhaust air excurrent canal 23 through the 3rd silence room 33, the inner pipe 22, and the 1st silence room 31, and bore 21a, the 2nd silence room 32, bore 22a, the inner pipe 22 and the 1st silence room 31.

[0011] By the way, if a lot of exhaust gas flows into the exhaust air inhalant canal 21 with high-speed rotation of an internal combustion engine, in the distribution channel of the two above-mentioned exhaust gas, the exhaust pressure in the silence room 32 and 33 will change highly, as a result the output of an internal combustion engine will decline.

[0012] For this reason, opening 14a for bypass paths which makes the 1st separator 14 open the 2nd silence room 32 and the 1st silence room 31 for free passage is prepared. When an exhaust pressure rises to place constant pressure, the bulb equipment 4 which opens a bypass path is formed in this opening 14a, and a lot of exhaust gas is made to be discharged by three distribution channels which added the

bypass path to the two above-mentioned lines by the atmosphere smoothly in the high rotation region of an internal combustion engine.

[0013] bulb equipment 4 opens and closes the housing 42 which has a valve port 41, and a valve port 41, as shown in drawing 2 -- a bulb -- it bent elastically and has the tabular valve 43 which can deform, and it \*\*\*\*s so that a valve port 41 may agree in the 1st separator 14 at the aforementioned opening 14a, and housing 42 is stopped 44 and carried out

[0014] Housing 42 is formed by the square shape member which consists of forging or a cast, forms a valve port 41 in the center section, and forms in the side by the side of the exhaust air effluence of gas valve seat section 42a which carried out opening of the valve port 41 to bulb fixed part 42b which adjoins a valve port 41. This valve seat section 42a is formed in the concave curved surface which starts enlarging radius of curvature gradually towards the side which counters bulb fixed part 42b from the bulb fixed part 42b side. and the stopper of the tabular which regulates the bending by the side of the aperture of a tabular valve 43 for end section 43a of a tabular valve 43 -- a member 46 -- \*\*\*\*ing -- 45 -- bulb fixed part 42b of housing 42 -- \*\*\*\*\* (ing) -- a stopper -- it has prevented that a tabular valve 43 bends too much in an aperture side by the member 46

[0015] the 1st sheet metal with which a tabular valve 43 is located in the upstream of an exhaust air gas stream -- a member -- 43A and the 2nd sheet metal located in a downstream -- a member -- a laminated structure with 43B -- it is -- both sheet metal -- end section 43a \*\*\*\* the mutual joint part of Members 43A and 43B, and according to 45 -- carrying out -- bending deformation of a tabular valve 43 -- both sheet metal -- it is made to produce mutual friction of Members 43A and 43B the state where the tabular valve 43 bent and it deformed -- the 1st sheet metal of an upstream -- a member, in 43A, it will sit down to valve seat section 42a, a valve port 41 will be blockaded, and a tabular valve 43 will be energized by the elastic stability by bending deformation of self in this state at a closing side And when it becomes more than the place constant pressure by which the exhaust pressure in the 2nd silence room 32 is equivalent to the elastic stability of a tabular valve 43, a tabular valve 43 bends in an aperture side, a valve port 41 is opened, and exhaust gas flows for a bypass path. if a tabular valve 43 carries out opening-and-closing vibration by change of an exhaust pressure here -- both the 1st and 2nd sheet metal -- friction between member 43A and 43B is produced, and the energy of opening-and-closing vibration is diffused as heat energy, therefore oscillating amplification of a tabular valve 43 is suppressed, and resonance is prevented

[0016] moreover -- for preventing resonance of a tabular valve 43 more effectively -- both the 1st and 2nd sheet metal -- to make the resonant frequency of Members 43A and 43B different from \*\* is desired then -- this operation gestalt -- the 1st sheet metal -- a member -- the board thickness  $t_1$  of 43A -- for example, 0.15mm and the 2nd sheet metal -- a member -- board thickness  $t_2$  of 43B was set to 0.1mm, and it has set up so that it may be set to  $t_1 > t_2$  according to this -- both sheet metal -- the 1st sheet metal which strikes valve seat section 42a while distinguishing between the resonant frequency of Members 43A and 43B and being able to suppress resonance of a tabular valve 43 effectively -- a member -- the endurance of 43A, as a result the endurance of a tabular valve 43 can be improved

[0017] Drawing 3 shows the 2nd operation form of bulb equipment 4, and gives the same sign to the same member as the 1st operation form shown in drawing 2. the 1st sheet metal located in an upstream with this 2nd operation form as shown in drawing 3 (A) and drawing 3 (B) -- a member -- the 2nd sheet metal located in a downstream in the area of 43A -- a member -- it enlarges as compared with the area of 43B, and as shown in the peripheral face except the end section 43a side of a tabular valve 43 at drawing 3 (C), level difference 43b of the predetermined width of face W (for example, 1.5mm) is formed according to this, an exhaust air gas stream involves in a level difference 43b portion at the time of valve opening of a tabular valve 43 -- having -- the 1st sheet metal -- a member -- 43A -- the 2nd sheet metal -- a member -- the force forced on 43B -- generating -- both the 1st and 2nd sheet metal -- the frictional force between member 43A and 43B increases, and a periodic-damping property improves

[0018] Drawing 4 shows the 3rd operation gestalt of bulb equipment 4. The housing 402 of the bulb equipment 4 of this 3rd operation gestalt Are formed in the shape of [ which uses inner circumference space as a valve port 401 ] a square pipe steel, and raise the one-side portion of one opening edge of this housing 402, and bulb fixed part 402b is formed. this -- end section 403a of a tabular valve 403, and a stopper -- enclosure wall 402a which \*\*\*\*\* a member 406, \*\*\*\*\* by 405 and encloses a tabular valve 403 with pipe walls other than bulb fixed part 402b of housing 402 is constituted

[0019] end section 403a It is what accepts, comes out, joins together and carries out a laminating, and changes about Members 403A, 403B, and 403C. this tabular valve 403 -- the 1st or 3rd sheet metal of three sheets -- the 1st sheet metal -- a member -- the size which carries out abbreviation agreement of the 403A at a valve port 401 -- carrying out -- the length from end section 403a to the other end -- the 1st sheet metal -- member 403A -- the 2nd sheet metal -- member 403B and the 3rd sheet

metal -- a member -- the order of 403C -- short -- carrying out -- the downstream from the upstream of an exhaust air gas stream -- turning -- the 1st sheet metal -- member 403A and the 2nd sheet metal -- member 403B and the 3rd sheet metal -- a member -- the laminating is carried out to the order of 403C the time of a tabular valve 403 bending in a downstream according to this -- these sheet metal -- friction between Members 403A and 403B and 403C is produced, and vibration declines Moreover, the flexural rigidity of a tabular valve 403 becomes low in order towards end section 403a to the other end, and the opening property that the opening of a tabular valve 403 changes gradually according to the increase in an exhaust pressure can be acquired.

[0020] Drawing 5 shows the 4th operation gestalt of bulb equipment 4. The difference between this 4th operation gestalt and the above-mentioned 3rd operation gestalt is the 1st or that the 3rd operation gestalt made reverse built-up sequence of Members 403A, 403B, and 403C the 3rd sheet metal. the time of a tabular valve 403 being bent by the fall of the gas pressure of the upstream of bulb equipment 4 in an upstream according to this -- sheet metal -- friction between Members 403A and 403B and 403C is produced, and vibration declines

[0021] Moreover, although it is made to sit down in the thing of the above 1st and the 2nd operation gestalt in the state where the tabular valve 43 was made to bend and transform into valve seat section 42a of housing 42, this invention is applicable also like the bulb equipment it was made to sit the valve seat section, without bending and making a tabular valve transform.

[0022]

[Effect of the Invention] According to this invention, the energy of opening-and-closing vibration of the tabular valve by change of exhaust air pressure is made to diffuse, and resonance of a tabular valve can be suppressed so that clearly from the above explanation.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] The cutting side elevation of an example of a silencer equipped with the bulb equipment concerning this invention

[Drawing 2] The cutting side elevation of the 1st operation gestalt of bulb equipment



[Drawing 3] (A) The cutting side elevation of the 2nd operation gestalt of bulb equipment

(B) The left lateral view of drawing 3 (A)

(C) The IIIC-IIIC line expansion cutting side view of drawing 3 (B)

[Drawing 4] The cutting side elevation of the 3rd operation gestalt of bulb equipment

[Drawing 5] The cutting side elevation of the 4th operation gestalt of bulb equipment

[Description of Notations]

1 Silencer

4 Bulb Equipment

41,401 Valve port

42,402 Housing

43,403 Tabular valve

43a, 403a End section

43b Level difference

43A, 43B, 403A-403C sheet metal — member

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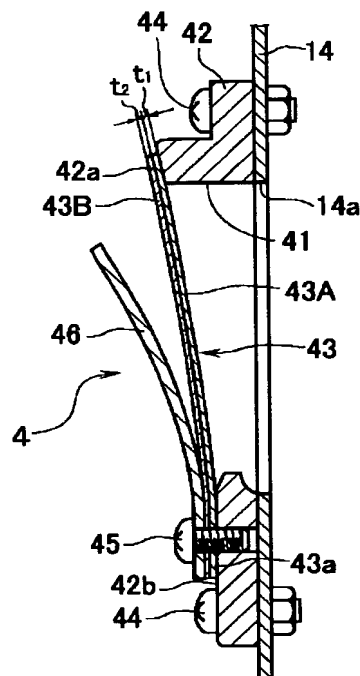
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(54)【発明の名称】 消音器用バルブ装置

(57)【要約】

【課題】消音器内の排気ガスのバイパス経路を排気圧が所定圧に上昇したときに開くバルブ装置4であって、排気ガスが流通する弁孔41を有するハウジング42と、弁孔41を開閉するバルブとを備え、バルブを弾性的に撓み変形可能で一端部43aをハウジング42のバルブ固定部42bに固定した板状弁43で構成するものにおいて、排気圧の変動による板状弁43の共振を抑制する。

【解決手段】板状弁43を排気ガス流の上流に位置する第1薄板部材43Aと、下流に位置する第2薄板部材43Bとの積層構造とし、板状弁43の撓み変形でこれら第1と第2の両薄板部材43A、43B間に摩擦が生じるようにする。また、第1薄板部材43Aの板厚を第2薄板部材43Bの板厚に比較して厚くし、両薄板部材43A、43Bの固有振動数を互いに相違させる。



## 【特許請求の範囲】

【請求項1】 消音器内の排気ガスのバイパス経路を排気圧が所定圧に上昇したときに開くバルブ装置であって、排気ガスが流通する弁孔を有するハウジングと、弁孔を開閉するバルブとを備え、バルブを弾性的に撓み変形可能で一端部をハウジングに固定した板状弁で構成するものにおいて、該板状弁を複数の薄板部材による積層構造とし、板状弁の撓み変形でこれら薄板部材相互の摩擦が生じるようにしたことを特徴とする消音器用バルブ装置。

【請求項2】 前記複数の薄板部材の中で、排気ガス流の上流側に位置する薄板部材の板厚を、下流側に位置する薄板部材の板厚に比較して厚くしたことを特徴とする請求項1記載の消音器用バルブ装置。

【請求項3】 前記複数の薄板部材の中で、排気ガス流の上流側に位置する薄板部材の面積を、下流側に位置する薄板部材の面積に比較して大きくし、板状弁の外周面に段差を形成したことを特徴とする請求項1及び2記載の消音器用バルブ装置。

【請求項4】 前記複数の薄板部材の一端部から他端部までの長さに差を付けたことを特徴とする請求項1及び2記載の消音器用バルブ装置。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】本発明は、主として車両用エンジンの排気系に介設する消音器用のバルブ装置に関し、更に詳細には、消音器内の排気ガスのバイパス経路を排気圧が所定圧に上昇したときに開くバルブ装置に関する。

## 【0002】

【従来の技術】本願出願人は、先に、この種のバルブ装置として、特願平10-110580号により、排気ガスが流通する弁孔を有するハウジングと、弁孔を開閉するバルブとを備え、バルブを弾性的に撓み変形可能で一端部をハウジングに固定した板状弁で構成し、板状弁を固定したハウジング面の弁孔の周縁に設けた弁座部に、板状弁が自己の撓み変形による弾性復元力で閉じ側に付勢された状態で着座させられ、この弾性復元力を上回る排気圧が板状弁に作用したときに板状弁が開き側に撓んで弁孔が開かれるようにしたもののや、特願平10-177414号により、角パイプを輪切りにしてハウジングを形成し、この角パイプ製ハウジングの一方の開口端の一边部分を切り起こしてバルブ固定部を形成すると共に、これに板状弁をねじ止めし、ハウジングのバルブ固定部以外のパイプ壁で板状弁を囲う囲い壁を構成して、板状弁が着座する弁座を省略したものを提案している。

## 【0003】

【発明が解決しようとする課題】上記従来例のものである、排気ガス流によって開閉させられる板状弁に開閉振動が生じるが、この開閉振動数が単一部材で形成される

板状弁の固有振動数と一致すると板状弁が共振することになる。この板状弁の共振は、板状弁の撓み変形、即ち、バルブの開度が大きくなると強くなってしまう。従って、エンジンの馬力アップを図るために、バルブの最大開度を大きくしたくても、要求通りに開度を設定できなくなる。

【0004】本発明は、以上の点に鑑み、板状弁の共振を抑制し得るようにした消音器用バルブ装置を提供することを課題としている。

## 【0005】

【課題を解決するための手段】上記課題を解決すべく、本発明では、消音器内の排気ガスのバイパス経路を排気圧が所定圧に上昇したときに開くバルブ装置であって、排気ガスが流通する弁孔を有するハウジングと、弁孔を開閉するバルブとを備え、バルブを弾性的に撓み変形可能で一端部をハウジングに固定した板状弁で構成するものにおいて、該板状弁を複数の薄板部材による積層構造とし、板状弁の撓み変形でこれら薄板部材相互の摩擦が生じるようにしている。

【0006】これによれば、板状弁の開閉振動により構成部材である複数の各薄板部材も同じ開閉振動を繰り返すが、この際、対向する薄板部材間に摩擦による摩擦熱が生じて、開閉振動のエネルギーが熱エネルギーとして放散されるため、板状弁の振動増幅を防止することができる。

【0007】また、板状弁の共振をより効果的に抑制するには、各薄板部材の固有振動数を互に相違させることが望まれ、それには各薄板部材の板厚や面積や長さを互に相違させれば良い。ここで、弁座に板状弁が着座するタイプのバルブ装置では、板状弁が弁座を叩くため、板状弁の耐久性を確保する上で、弁座側、即ち、排気ガス流の上流側に位置する薄板部材の板厚を、下流側に位置する薄板部材の板厚に比較して厚くすることが望ましい。また、排気ガス流の上流側に位置する薄板部材の面積を、下流側に位置する薄板部材の面積に比較して大きくし、板状弁の外周面に段差を形成すれば、板状弁の開閉時に前記段差への排気ガス流の巻き込みで上流側の薄板部材を下流側の薄板部材に押し付ける力が発生し、薄板部材間の摩擦力が増加して振動減衰特性が向上する。

## 【0008】

【発明の実施の形態】図1を参照して、1は内燃機関の排気系の途中に介設される消音器であり、筒状のシェル11と、シェル11の一端と他端とを閉塞する端壁12、13とで構成される消音器本体内に、第1と第2の1対のセパレータ14、15を設け、本体内の空間を、一端壁12と第1セパレータ14との間の第1消音室31と、第1セパレータ14と第2セパレータ15との間の第2消音室32と、第2セパレータ15と他端壁13との間の第3消音室33とに区劃している。更に、消

音器1に、一端壁12と第1セパレータ14と第2セパレータ15とを夫々貫通して第3消音室33と連通する排気流入管21と、第2セパレータ15と第1セパレータ14とを夫々貫通して第3消音室33と第1消音室31とを連通するインナーパイプ22と、第1セパレータ14と第2セパレータ15と他端壁13とを夫々貫通して第1消音室31を大気に連通させる排気流出管23とを設けている。

【0009】そして、排気流入管21の第2消音室32部分の管壁に多数の透孔21aを穿設すると共に、インナーパイプ22の第2消音室32部分の管壁にも多数の透孔22aを穿設して、排気流入管21とインナーパイプ22とを第2消音室32を介して連通できる構造とする。

【0010】これによれば、排気流入管21に流入した排気ガスの流通経路は、第3消音室33とインナーパイプ22と第1消音室31とを介して排気流出管23に至る経路と、透孔21aと第2消音室32と透孔22aとインナーパイプ22と第1消音室31とを介して排気流出管23に至る経路との2系統になる。

【0011】ところで、内燃機関の高速回転に伴って多量の排気ガスが排気流入管21に流入すると、上記2系統だけの排気ガスの流通経路では消音室32、33内の排気圧が高く成り、ひいては、内燃機関の出力が低下する。

【0012】このため、第1セパレータ14に、第2消音室32と第1消音室31とを連通させるバイパス経路用の開口部14aを設け、この開口部14aに、排気圧が所定圧に上昇したときにバイパス経路を開くバルブ装置4を設け、内燃機関の高回転域では、上記した2系統にバイパス経路を追加した3系統の流通経路で多量の排気ガスが大気にスムーズに排出されるようにしている。

【0013】バルブ装置4は、図2に示すように、弁孔41を有するハウジング42と、弁孔41を開閉するバルブたる、弾性的に撓み変形可能な板状弁43とを備えており、ハウジング42を第1セパレータ14に弁孔41が前記開口部14aに合致するようにねじ44止めしている。

【0014】ハウジング42は、鍛造または鋳造品から成る角形部材で形成され、その中央部に弁孔41を設け、排気ガス流出側の側面には弁孔41に隣接するバルブ固定部42bと弁孔41を開口させた弁座部42aとを形成している。この弁座部42aは、バルブ固定部42b側からバルブ固定部42bに対向する側に向けて曲率半径を徐々に大きくしつつ立ち上がる凹曲面に形成されている。そして、板状弁43の一端部43aを、板状弁43の開き側への撓みを規制する板状のストッパ部材46と共にねじ45でハウジング42のバルブ固定部42bに共締めし、ストッパ部材46により板状弁43が開き側に過度に撓むことを防止している。

【0015】板状弁43は、排気ガス流の上流側に位置する第1薄板部材43Aと、下流側に位置する第2薄板部材43Bとの積層構造であり、両薄板部材43A、43Bの相互の結合箇所をねじ45による一端部43aのみとし、板状弁43の撓み変形で両薄板部材43A、43Bの相互の摩擦を生ずるようにしている。板状弁43は撓み変形した状態で上流側の第1薄板部材43Aにおいて弁座部42aに着座して弁孔41を閉塞し、この状態において、板状弁43は自己の撓み変形による弾性復元力で閉じ側に付勢されることになる。そして、第2消音室32内の排気圧が板状弁43の弾性復元力に相当する所定圧以上になったとき、板状弁43が開き側に撓み、弁孔41が開かれてバイパス経路に排気ガスが流れる。ここで、排気圧の変動により板状弁43が開閉振動すると、第1と第2の両薄板部材43A、43B間の摩擦を生じ、開閉振動のエネルギーが熱エネルギーとして放散され、そのため、板状弁43の振動増幅が抑制されて共振が防止される。

【0016】また、板状弁43の共振をより効果的に防止するには、第1と第2の両薄板部材43A、43Bの固有振動数を互に相違させることが望まれる。そこで、本実施形態では、第1薄板部材43Aの板厚 $t_1$ を例えば0.15mm、第2薄板部材43Bの板厚 $t_2$ を例えば0.1mmにして、 $t_1 > t_2$ になるように設定している。これによれば、両薄板部材43A、43Bの固有振動数に差を付けて、板状弁43の共振を効果的に抑制できると共に、弁座部42aを叩く第1薄板部材43Aの耐久性、ひいては板状弁43の耐久性を向上できる。

【0017】図3はバルブ装置4の第2実施形態を示しており、図2に示した第1実施形態と同一の部材には同一の符号を付している。この第2実施形態では、図3(A)や図3(B)に示す如く、上流側に位置する第1薄板部材43Aの面積を、下流側に位置する第2薄板部材43Bの面積に比較して大きくし、板状弁43の一端部43a側を除く外周面に、図3(C)に示す如く、所定幅 $W$ (例えば1.5mm)の段差43bを形成している。これによれば、板状弁43の開弁時に排気ガス流が段差43b部分に巻き込まれて、第1薄板部材43Aを第2薄板部材43Bに押し付ける力が発生し、第1と第2の両薄板部材43A、43B間の摩擦力が増加して振動減衰特性が向上する。

【0018】図4はバルブ装置4の第3実施形態を示している。この第3実施形態のバルブ装置4のハウジング402は、内周空間を弁孔401とする角パイプ状に形成されており、このハウジング402の一方の開口端の一辺部分を切り起こしてバルブ固定部402bを形成し、これに板状弁403の一端部403a及びストッパ部材406をねじ405で共締めし、ハウジング402のバルブ固定部402b以外のパイプ壁で板状弁403

を囲う囲い壁402aを構成している。

【0019】この板状弁403は、第1乃至第3の3枚の薄板部材403A、403B、403Cを一端部403aのみで結合して積層して成るもので、第1薄板部材403Aを弁孔401に略合致する大きさとし、一端部403aから他端部までの長さを第1薄板部材403A、第2薄板部材403B、第3薄板部材403Cの順に短くし、排気ガス流の上流側から下流側に向けて第1薄板部材403A、第2薄板部材403B、第3薄板部材403Cの順に積層している。これによれば、板状弁403が下流側に撓む際にこれら薄板部材403A、403B、403C間の摩擦を生じて振動が減衰される。また、板状弁403の曲げ剛性が一端部403aから他端部に向けて順に低くなり、排気圧の増加に応じて板状弁403の開度が段階的に変化するような開度特性を得られる。

【0020】図5はバルブ装置4の第4実施形態を示している。この第4実施形態と上記第3実施形態との相違点は、第1乃至第3薄板部材403A、403B、403Cの積層順序を第3実施形態とは逆にしたことである。これによれば、バルブ装置4の上流側のガス圧の低下で板状弁403が上流側に撓む時に、薄板部材403A、403B、403C間の摩擦を生じて振動が減衰される。

【0021】また、上記第1、第2実施形態のものは、板状弁43をハウジング42の弁座部42aに撓み

変形させた状態で着座させているが、板状弁を撓み変形させずに弁座部に着座させるようにしたバルブ装置にも同様に本発明を適用できる。

【0022】

【発明の効果】以上の説明から明らかなように、本発明によれば、排気ガス圧の変動による板状弁の開閉振動のエネルギーを放散させて、板状弁の共振を抑制できる。

【図面の簡単な説明】

【図1】 本発明に係るバルブ装置を備える消音器の一例の截断側面図

【図2】 バルブ装置の第1実施形態の截断側面図

【図3】 (A) バルブ装置の第2実施形態の截断側面図

(B) 図3 (A) の左側面図

(C) 図3 (B) のIII C-III C線拡大截断側面図

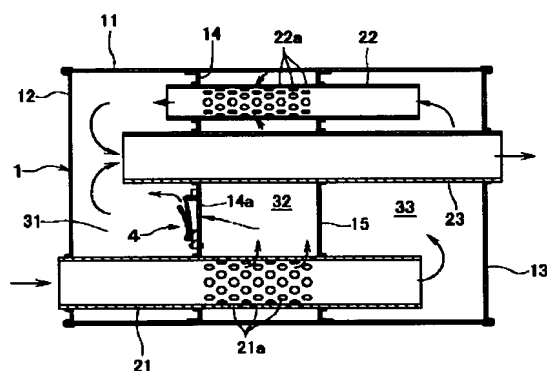
【図4】 バルブ装置の第3実施形態の截断側面図

【図5】 バルブ装置の第4実施形態の截断側面図

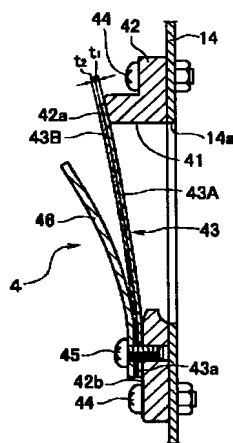
【符号の説明】

- 1 消音器
- 4 バルブ装置
- 41、401 弁孔
- 42、402 ハウジング
- 43、403 板状弁
- 43a、403a 一端部
- 43b 段差
- 43A、43B、403A～403C 薄板部材

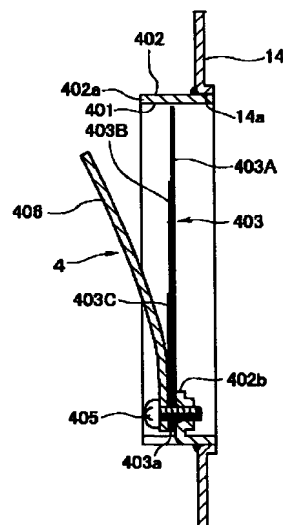
【図1】



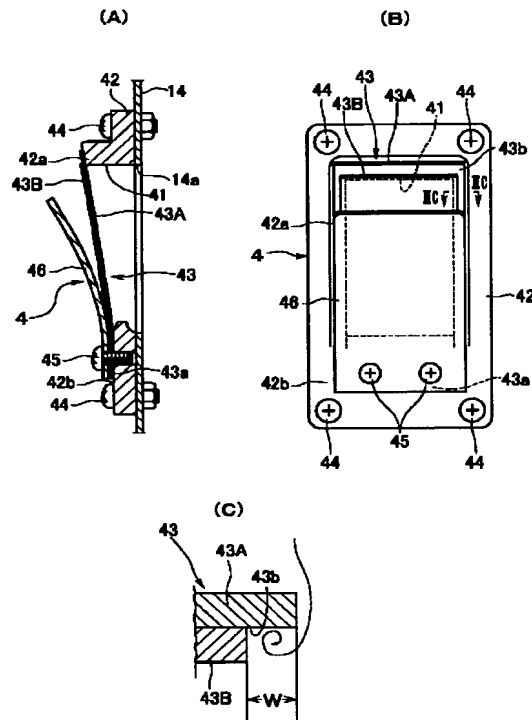
【図2】



【図4】



【図3】



【図5】

